Modeling Three-Dimensional Wave Propagation in the San Francisco Bay Area
Final Technical Report May 7, 2001

Award: 99HQGR0057

Investigator: Douglas S. Dreger

Address:
Seismological Laboratory
University of California, Berkeley
281 McCone Hall
Berkeley, CA 94720

Contact Information:
Office: (510) 643-1719
Fax: (510) 643-5811
Email: dreger@seismo.berkeley.edu

Program Element: II

Key words: wave propagation, strong ground motion, amplification

Technical Abstract

We have constructed a 3D velocity model of the San Francisco Bay Area for the crust and upper mantle, on the basis of geological information, seismological results and gravity modeling. The San Francisco Bay Area is modeled as blocks of alluvium (including San Francisco Bay, San Pablo Bay, Sacramento River delta, Livermore Valley, Concord Valley, and Santa Clara Valley) and of bedrock with vertical gradients and across-fault velocity contrasts. In addition, a 3D velocity model has been constructed by the USGS for the region. A 3D finite difference code is applied to the parameterized 3D velocity models to calculate synthetic seismograms for frequencies up to 0.5 Hz. These are compared to recorded seismograms of the 12 August, 1998 M_W5.1 San Juan Bautista earthquake to test the accuracy of the models. We find that both 3D velocity models result in significant amplification in the Santa Clara Valley and are reasonably good first order predictors of maximum horizontal peak ground velocity in the 0.1 to 0.5 Hz passband. There is considerable scatter in ratios of observed and predicted ground motions, and the waveform fitting succeeds in matching extended durations, but detailed phase matching is poor. The results indicate that additional modeling and a continued monitoring effort in the Santa Clara Valley are needed.

Research supported by the U.S. Geological Survey (USGS), Department of the Interior, under USGS award number 99HQGR0057. *The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U. S. Government.*